

ZEOLITE FORMATION AND WEATHERING PROCESSES IN DRY VALLEYS OF ANTARCTICA: MARTIAN ANALOGS.

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Terrestrial weathering processes in cold-desert climates such as the Dry Valleys of Antarctica may provide an excellent analog to chemical weathering and diagenesis of soils on Mars. Detailed studies of soil development and the chemical and mineralogical alterations occurring within soil columns in Wright Valley, Antarctica show incredible complexity in the upper meter of soil. Previous workers noted the ice-free Dry Valleys are the best terrestrial approximations to contemporary Mars. Images returned from the Pathfinder and Spirit landers show similarities to surfaces observed within the Dry Valleys. Similarities to Mars that exist in these valleys are: mean temperatures always below freezing (-20°C), no rainfall, sparse snowfall-rapidly removed by sublimation, desiccating winds, diurnal freeze-thaw cycles (even during daylight hours), low humidity, oxidative environment, relatively high solar radiation and low magnetic fields. The Dry Valley soils contain irregular distributions and low abundances of soil microorganisms that are somewhat unusual on Earth.

Physical processes-such as sand abrasion-are dominant mechanisms of rock weathering in Antarctica. However, chemical weathering is also an important process even in such extreme climates. For example, ionic migration occurs even in frozen soils along liquid films on individual soil particles. It has also been shown that water with liquid-like properties is present in soils at temperatures on the order of ~-80°C and it has been observed that the percentage of oxidized iron increases with increasing soil age and enrichments in oxidized iron occurs toward the surface. The presence of evaporates is evident and appear similar to "evaporite sites" within the Pathfinder and Spirit sites. Evaporites indicate ionic migration and chemical activity even in the permanently frozen zone. The presence of evaporates indicates that chemical weathering of rocks and possibly soils has been active.

Authigenic zeolites have been identified within the soil columns because they are fragile; i.e. they are euhedral, unabraded, and unfractured, strongly suggesting *in situ* formation. Their presence in Antarctic samples is another indication that diagenic processes are active in cold-desert environments. The presence of zeolites, and other clays along with halites, sulfates, carbonates, and hydrates are to be expected within the soil columns on Mars at the Gusev and Isidis Planitia regions. The presence of such water-bearing minerals beneath the surface supplies one of the requirements to support biological activity on Mars.